ANALYSIS OF AOTF HYPERSPECTRAL IMAGERY*

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This paper reports a preliminary result from an analysis of hyperspectral imagery collected using a prototype acousto-optic tunable filter (AOTF) system in an outdoor environment,

AOTF is a high resolution, rapidly tunable spectral bandpass filter which uses the diffraction of an incident light beam at a moving grating produced by an acoustic wave in a birefringent crystal. An AOTF instrument is capable of observing two orthogonally polarized images at a desired wavelength at one time. The selection of operating wavelength is done by tuning the frequency of a RF power supply to a transducer mounted on the crystal. Therefore, the filter can operate in a sequential, random (wavelength hopping), or multiple wavelength mode, providing a unique operational flexibility. Furthermore, AOTFS can provide high spectral resolution ($\lambda/\Delta\lambda$) of 102-104. This high resolution capability gives opportunities to characterize materials through the remote sensing of reflection, absorption, or emission spectra. The prototype AOTF system using a $Te0_2$ AOTF operates in a wavelength range of 0.48-0.76 microns.

The objective of this analysis is to evaluate the AOTF technology for remote sensing applications. After the observation, each data set was formulated into a number of image-wavelength cubes **for exploiting the advantages of this technology.** They include the cubes in first and second spectral derivative domains for each polarization. The results have demonstrated the AOTF capability of detecting targets in the natural environment, mapping healthy vegetation, and observing polarization signatures of both natural and man-made objects. In addition, the results also illustrate that the observed spectrum of an object in a natural environment is often a mixing of the object and those of the near surroundings.

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